

APPLICATION FOR UNITED STATES LETTERS PATENT

INVENTOR(S): Yoko KIKUTA
 Masami YABUSAKI

INVENTION: MOBILE COMMUNICATION
 METHOD AND MOBILE
 COMMUNICATION SYSTEM

S P E C I F I C A T I O N

This application is based on Patent Application No. 2000-343887 filed November 10, 2000 in Japan, the content of which is incorporated hereinto by reference.

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BACKGROUND OF THE INVENTION

FIELD OF THE INVENTION

The present invention relates to a mobile
10 communication method and a mobile communication system wherein, in the case of sharing a plurality of mobile terminals for users, a call being communicated can be switched and transferred to another available mobile terminal.

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DESCRIPTION OF RELATED ART

With the recent spread of mobile communications, users have become more and more opportunities to use a plurality
20 of mobile terminals as required.

For example, a plurality of mobile terminals for business and personal communications, or a vehicle-mounted high-power terminal and a light and small mobile terminal, or a PC card type data communication terminal
25 and a mobile terminal with a voice function can be used as required.

With a conventional mobile communication system, a

user can use the same telephone number for a plurality of mobile terminals to which the user is subscribed (Japanese Patent Application Laid-open No. 11-234748).

However, switching operations for mobile terminals
5 are limited to one from a mobile terminal that is unavailable during the switching operation, and switching operations from an available mobile terminal are not permitted.

Further, switching operations for mobile terminals
10 are limited to only while all of the mobile terminals are being controlled during non-communicating.

As a result, the following problems may occur.

First, to allow a plurality of mobile terminals to use the same telephone number, the device numbers of
15 desired mobile terminals must be registered preliminarily in a database in a service control station.

Furthermore, while a user under such a contract that the same telephone number can be communicated by using a plurality of the mobile terminals, if it has become
20 difficult to continue the communication due to the exhaustion of batteries in the mobile terminal or worsened conditions for radio wave propagation, then in spite of the plurality of mobile terminals available for the same telephone number, the user cannot continue the
25 communication by switching a call being communicated by this mobile terminal to another mobile terminal because the switching operation is not permitted while one of the

mobile terminals is used for the communication.

SUMMARY OF THE INVENTION

5 It is an object of the present invention to provide
a mobile communication method and a mobile communication
system wherein, when it becomes difficult to continue the
communication while a user is communicating by using one
mobile terminal, a user can switch a call being
10 communicated to another terminal available for the same
number to continue the communication, thus improving the
user's convenience.

 In a first aspect of the present invention, there is
provided a mobile communication method for controlling a
15 transfer switching during communication between a
plurality of terminals sharing a same number and a
communication control station,

 wherein any one of the plurality of terminals
comprises steps of:

20 determining whether or not to switch a transfer to
any of the terminals sharing the same number;

 authenticating, if it is determined that the transfer
is to be switched, one of the terminals sharing the same
number to which the transfer is switched; and

25 outputting a transfer switching request according to
the authenticated terminal to the communication control
station, and

wherein the communication control station comprises a step of:

performing a process of switching the transfer to the authenticated terminal based on the transfer switching
5 request outputted from the terminal.

Here, if the one terminal is communicating, this terminal may automatically authenticate one of the other terminals with which the terminal can communicate by using the same number, and

10 the authenticating terminal may output a transfer switching request according to the another authenticated terminal to the communication control station.

If the one terminal is communicating, this terminal may automatically authenticate one of the other terminals
15 with which the terminal can communicate by using the same number, and

the another authenticated terminal may output a transfer switching request according to the authenticated terminal to the communication control station.

20 The communication control station may further comprise steps of:

storing a switching request information concerning the transfer switching request corresponding to the each terminal sharing the same number;

25 determining whether the authenticating terminal or the another authenticated terminal has provided an output; and

performing, if it is determined that the another terminal has provided an output, a process of switching the transfer based on the switching request information stored in the storage means.

5 In a second aspect of the present invention, there is provided a mobile communication system for controlling a transfer switching during communication between a plurality of terminals sharing a same number and a communication control station,

10 wherein any one of the plurality of terminals comprises:
determination means for determining whether or not to switch a transfer to any of the terminals sharing the same number;

15 authentication means for authenticating, if it is determined that the transfer is to be switched, one of the terminals sharing the same number to which the transfer is switched; and

20 output means for outputting a transfer switching request according to the authenticated terminal to the communication control station, and

 wherein the communication control station comprises:
transfer switching means for performing a process of switching the transfer to the authenticated terminal based
25 on the transfer switching request outputted from the terminal.

 Here, the authentication means may comprise:

if the one terminal is communicating, this terminal may automatically authenticate one of the other terminals with which the terminal can communicate by using the same number, and

5 the output means may comprise:

the authenticating terminal may output a transfer switching request according to the another authenticated terminal to the communication control station.

The authentication means may comprise:

10 if the one terminal is communicating, this terminal may automatically authenticate one of the other terminals with which the terminal can communicate by using the same number, and

the output means may comprise:

15 the another authenticated terminal may output a transfer switching request according to the authenticated terminal to the communication control station.

The communication control station may further comprise:

20 storage means for storing a switching request information concerning the transfer switching request corresponding to the each terminal sharing the same number;

determination means for determining whether the authenticating terminal or the another authenticated
25 terminal has provided an output; and

control means for performing, if it is determined that the another terminal has provided an output, a transfer

switching process based on the switching request
information stored in the storage means.

In a third aspect of the present invention, there is
provided a communication control station for controlling
5 a transfer switching for communication between a plurality
of terminals sharing the same number,

the station comprises of:

storage means for storing a switching request
information concerning a transfer switching request
10 corresponding to the each terminal sharing the same number;
and

control means for performing a transfer switching
process based on the switching request information stored
in the storage means.

15 The switching request information stored in the
storage means may include at least the same number shared
among terminals, a device number, a location information
and an availability flag,

wherein the location information and the availability
20 flag correspond to the device number.

In a fourth aspect of the present invention, there
is provided a terminal device for controlling a transfer
switching for communication between other terminals
sharing a same number,

25 the device comprises of:

detection means for detecting a terminal available
for the same number;

transfer request means for performing a transfer request to the detected terminal available for the same number, and

authentication request means for performing an
5 authentication request based on the transfer request received from the terminal available for the same number.

In a fifth aspect of the present invention, there is provided a method for controlling a transfer switching for communication between at least two terminals sharing a same
10 number,

the method comprises the steps of:

detecting a terminal available for the same number among terminals sharing the same number of the predetermined terminal,

15 performing a transfer request to the detected terminal available for the same number, and

performing an authentication request based on the transfer request received from the terminal available for the same number.

20 The above and other objects, effects, features and advantages of the present invention will become more apparent from the following description of embodiments thereof taken in conjunction with the accompanying drawings.

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BRIEF DESCRIPTION OF DRAWINGS

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Figs. 1A and 1B are block diagrams showing the entire configuration of a mobile communication system as a first embodiment of the present invention;

Fig. 2 is an explanatory representation showing the configuration of a database included a service control station;

Fig. 3 is a flow chart showing an example of a process in the case of performing a transfer request during communication from a source mobile terminal to a network; and

Fig. 4 is a flow chart showing an example of a process in the case of performing a transfer request during communication from a destination mobile terminal to a network according to a second embodiment of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Embodiments of the present invention will be described below in detail with reference to the drawings.

[First Example]

First, a first embodiment of the present invention will be described with reference to Figs. 1 to 3.

(Summary)

The present invention relates to a mobile communication system composed of one or more terminals that

can share the same number and a service control apparatus having a storage area storing the device numbers of the one or more terminals and locational information corresponding to one number, wherein a call being
5 communicated by using one of the terminals is switched and transferred to another terminal available for the same number.

That is, when one of the terminals is communicating, authentication process is performed between the
10 communicated terminal and another terminal available for the same number to switch the call. In other words, when one of the terminals is communicating, another terminal available for the same number can be detected automatically to switch the call being communicated.

15 (Specific Example)

A specific example will be described below.

(System Configuration)

First, the configuration of the system will be described.

20 Figs. 1A and 1B show an example of the configuration of a mobile communication system according to the present invention.

This mobile communication system is composed of mobile terminals 1 to 3, base stations 11 to 14, switching stations
25 21 to 22, a service control station 30, and a communication line 40 that connects these components together.

The mobile terminals 1 to 3 are used by the same

subscriber and are imparted with individual device numbers MSI1, MSI2, and MSI3 as well as a common telephone number MSN, respectively.

In this case, the mobile terminal 1 is mounted in a vehicle, the mobile terminal 2 is portable, and the mobile terminal 3 is integrated with a data communication card.

In the following description, in which the same telephone number can be shared by a plurality of mobile terminals, users will be referred to as "multiple terminal subscribers".

As shown in Fig. 1B, the mobile terminals 1 to 3 include a detection portion 51, a transfer portion 52 and an authentication portion 53.

The detection portion 51 has a function that detects a terminal available for the same number (ex. the same telephone number).

The transfer portion 52 has a function that performs a transfer request to the detected terminal available for the same number.

The authentication portion 53 has a function that performs an authentication request based on said transfer request received from said terminal available for the same number.

The mobile terminals 1 to 3 support short-distance radio communications using bluetooth waves (very weak radiowaves) or the like and can communicate directly with each other.

The base stations 11 to 14 are installed at predetermined intervals and have a function of communicating a mobile terminal in a radio zone formed by each station.

5 The switching stations 21 and 22 accommodate a plurality of base stations and communicate with slave base stations and other switching stations to connect calls to the mobile terminals 1 to 4.

Reference numeral 30 denotes a service control station
10 internally having a database (DB) 31. This station 30 provides various pieces of information referring to the mobile terminals for the switching stations 21 to 22.

As shown in Figs. 1A and 1B, the service control station includes a storage portion 31a having the database
15 31, a determination portion 32 and a control portion 33.

The storage portion 31a has a function that stores a switching request information (see availability flag in Fig. 2) concerning the transfer switching request corresponding to each terminal sharing the same number.

20 The determination portion 32 has a function that determines whether an authenticating terminal or another authenticated terminal has provided an output.

The control portion 33 has a function that performs, if it is determined that the another terminal has provided
25 an output, a process of switching the transfer based on the switching request information stored in the storage portion 31a.

Fig. 2 shows the contents of data stored in the database 31 within the service control station 30.

A reference numeral 41 denotes a telephone number storage portion that stores subscribers' telephone numbers. A reference numeral 42 denotes a device number storage portion that stores one or more device numbers corresponding to one telephone number. A reference numeral 43 denotes a location information portion that stores the numbers of areas in which the mobile terminal corresponding to each the device number is present. A reference numeral 44 denotes an availability flag that stores "1" if the mobile terminal is available and stores "0" if the mobile terminal is unavailable.

Here, a mobile terminal set to "1", indicating that it is available, is one of the group of mobile terminals to which the same telephone number is assigned. The other mobile terminals are set to "0", indicating that they are unavailable.

The device number storage portion 42 stores the device numbers MSI1, MSI2, and MSI3, corresponding to the three mobile terminals 1 to 3, to which the telephone number MSN1 is assigned. The location information section 43 stores location information (terminal-located area numbers) A11, A12, and A13 on each mobile terminal corresponding to the device numbers MSI1, MSI2, and MSI3. In the availability flags 44 corresponding to the device numbers MSI1, MSI2, and MSI3, the one corresponding to the device number MSI1

is set to "1" indicating available, whereas the other mobile terminals are set to "0" indicating unavailable. (System Operation)

Now, an operation of this system will be described.

- 5 (1) If a source terminal performs a transfer request

The case in which a source terminal performs a transfer request will be described below.

Fig. 3 is a sequence diagram showing the case in which while a user A is communicating by using the mobile terminal
10 1 (hereafter referred to as the "mobile terminal A1"), a transfer request is performed from the mobile terminal A1 being used to a mobile communication network.

The user A is a multiple terminal subscriber and can use the mobile terminals A1, A2, and A3, to which the
15 telephone number MSN1 is assigned. The mobile terminals A1, A2, and A3 have the device numbers MSI1, MSI2, and MSI3, respectively.

While the mobile terminal A1 of the user A and the mobile terminal B1 of the user B (hereafter referred to
20 as a "mobile terminal B1") are communicating (step S1), if the mobile terminal A1 has become the difficulty continuing the communication due to the exhaustion of batteries, it autonomously detects the exhaustion and warns the user A of the difficulty by activating an alarm,
25 displaying a character message on a liquid crystal screen, or lighting a warning lamp (step S2).

The mobile terminal A1 detects the mobile terminal

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A2, which is located around and is available for continuing the current communication, among the mobile terminals A2 and A3 which can be used with the same telephone number MSN1 (step S3). The mobile terminal A1 then transmits a
5 transfer request to the mobile terminal A2 (step S4).

In this case, means for selecting the mobile terminal A2 may be either a method of allowing the mobile terminal A1 to autonomously detect the mobile terminal A2 or a method of allowing the user A, who has been warned of the
10 exhaustion, to intentionally select the mobile terminal A2.

Upon receiving the transfer request from the mobile terminal A1, the mobile terminal A2 transmits the device number MSI2 to the mobile terminal A1 to perform an
15 authentication request (step S5).

If the result of the authentication is affirmative, the mobile terminal A1 notifies the mobile terminal A2 of this result (step S6) and performs a transfer request to the switching station 21 so that the device number MSI1
20 is changed to the device number MSI2 (step S7).

Upon receiving the transfer request from the mobile terminal A1, the switching station 21 transmits an information rewrite request of the device number of the terminal being used to the service control station 30 (step
25 S8).

The service control station 30 determines whether or not this subscriber is being communicated (step S9). If

the subscriber is being communicated, the service control station 30 assumes that the transfer can be permitted, and then rewrites the availability flag in the database 31 (step S10). The service control station 30 then sets the
5 availability state of the device number MSI2 to "1", and transmits an information rewrite response to the switching station 21 (step S11).

This process sets the availability state of the mobile terminal A2 having the device number MSI2 to "1",
10 indicating that the terminal is available, while setting the availability state of the mobile terminal A1 having the device number MSI1, which has been communicating, to "0", indicating that the terminal is unavailable.

Upon receiving the information rewrite response from
15 the service control station 30, the switching station 21 performs a transfer process from the mobile terminal A1 to the mobile terminal A2 (step S12), and then transmits a transfer request response to the mobile terminal A2 (step S13).

20 This process clears a call setup with the mobile terminal A1 and performs a call setup with the mobile terminal A2, thus establishing communications between the mobile terminal B1 and the mobile terminal A2 (step S14).

Further, at step S9, if this subscriber is not
25 communicating when the service control station 30 receives the information rewrite request based on a transfer, the service control section 30 determines that the transfer

process is not to be permitted and then transmits an information rewrite response to the switching station 21 (step S15). The switching station 21, which has been notified that the transfer process is not to be permitted, 5 transmits a transfer request reject signal to the mobile terminal A1 to stop the transfer process (step S16).

In the above description, it is assumed that the user is a multiple terminal subscriber, but a user who is not a multiple terminal subscriber can perform the switching 10 and transferring process by directly rewriting the device number MSI in the device number storage portion instead of rewriting the availability flag in the database 31 of the service control station 30.

As described above, by performing the authentication 15 process and the switching process, if a user can use the same telephone number available for a plurality of mobile terminals, even if it has become difficulties continuing the communication due to the exhaustion of batteries, worsened conditions for radiowave propagation, a change 20 in surrounding environments caused by movement, or the like while one of the mobile terminals is communicating, the user can continue a call being communicated by transferring the call to another available mobile terminal.

25 [Second Example]

Next, a second embodiment of the present invention will be described with reference to Fig. 4. Description

of the same components as those in the first example is omitted, and they are denoted by the same reference numerals.

This is an example in which a destination terminal
5 performs a transfer request. The configuration of this system is the same as that of the system shown in Figs. 1A and 1B for the above-described first example, and description thereof is thus omitted.

A process that the destination terminal performs a
10 transfer request will be described below with reference to Fig. 4.

Fig. 4 shows an example of a sequence that while the user A is communicating by using the mobile terminal A1, the destination terminal performs a transfer request.

15 The user A is a multiple terminal subscriber and can use the mobile terminals A1, A2, and A3, to which the telephone number MSN1 is assigned. The mobile terminals A1, A2, and A3 have the device numbers MSI1, MSI2, and MSI3, respectively.

20 While the mobile terminal A1 of the user A and the mobile terminal B1 of the user B are communicating (step S31), if the mobile terminal A1 has become difficulty continuing the communication due to the exhaustion of batteries, it autonomously detects the exhaustion and
25 warns the user A of the difficulty by activating an alarm, displaying a character message on a liquid crystal screen, or lighting a warning lamp (step S32).

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The user A, who has been warned of the exhaustion, selects the mobile terminal A2 as one for continuing the current communication, among the mobile terminals A2 and A3 which can be used with the same telephone number MSN1
5 (step S33). The user A transmits a transfer request to the mobile terminal A2 (step S34).

In this case, means for selecting the mobile terminal A2 may be either a method of allowing the user A, who has been warned of the exhaustion, to intentionally select the
10 mobile terminal A2 or a method of allowing the mobile terminal A1 to autonomously detect the mobile terminal A2.

Upon receiving the transfer request, the mobile terminal A2 makes an authentication request to the mobile terminal A1 (step S35).

15 The mobile terminal A1 performs an authentication process and transmits an authentication response to the mobile terminal A2 (step S36).

Once the authentication has been achieved, the mobile terminal A2 transmits a transfer request to the switching
20 station 21 for a transfer process (step S37).

Upon receiving the transfer request from the mobile terminal A2, the switching station 21 transmits an information query request of the subscriber to the service control station 30 (step S38).

25 Upon receiving this request, the service control station 30 determines whether or not this subscriber is permitted in contracts of multiple terminals concerning

the telephone number MSN1 (step S39). If the subscriber is permitted in contracts of multiple terminals, then the service control section 30 shifts to a subsequent determination process.

5 If this subscriber is permitted in contracts of multiple terminals concerning the telephone number MSN1, then the service control section 30 determines whether or not other mobile terminals except the mobile terminal A2, which has transmitted the transfer request, are being
10 communicated, among all the mobile terminals A1 to A3 associated with the telephone number MSN1.

 If the service control section 30 determines that any of the mobile terminals except the mobile terminal A2 is being communicated, it assumes that the transfer is to be
15 permitted, and then rewrites the availability flag in the database 31 (step S41) to set it to "1", indicating that this terminal can be used for the terminal MSI2. Then, the service control section 30 transmits an information query response to the switching station 21.

20 This process sets the availability state of the mobile terminal A2 having the device number MSI2 to "1", indicating that the terminal is available, while setting the availability state of the mobile terminal A1 having the device number MSI1, which has been being communicated,
25 to "0", indicating that the terminal is unavailable.

 However, when it has been determined whether or not any of the mobile terminals except the mobile terminal A2

is being communicated, further, in the case of identifying the mobile terminal is being communicated, the information concerning all the mobile terminals that can share the same telephone number is stored previously in the database 31, and then when an information concerning a transfer request is transmitted from the mobile terminal A2, the stored information is referred, thus identifying the mobile terminal being communicated.

If it has been determined that the subscriber is permitted in contrasts of multiple terminals and that other terminals (in this case, the mobile terminal A1) of the subscriber is being communicated, the switching station 21, which has received the information query response, transfers the call being communicated from the mobile terminal A1 to the mobile terminal A2 (step S43).

After ascertaining that the communication with the mobile terminal A1 has ended, the switching station 21 transmits a transfer request response to the mobile terminal A2 (step S44).

When the mobile terminal A2 receives the transfer request response from the switching station 21, communications between the mobile terminal A2 of the user A and the mobile terminal B1 of the user B are established (step S45).

If the subscriber is not permitted in contrasts of multiple terminals concerning the telephone number MSN1 or the mobile terminals except the mobile terminal A2,

which has performed the transfer request, are not being communicated, then the service control station 30 communicates this state to the switching station 21 as an information query response (step S46). Upon receiving
5 this response, the switching station 21 rejects a call transfer and then transmits a transfer request reject response to the mobile terminal A2 (step S47).

In this example, the timing for detecting a transfer is regarded as when the batteries are exhausted, but this
10 may be based on any factor that the mobile terminal has difficulty in continuing the communication such as worsened radiowave conditions.

As the timing for performing a transfer autonomously by the mobile terminal, not only detecting the difficulty
15 of the communication continuation but also detecting a more appropriate terminal nearby can also be performed. For example, when the user gets in a car while communicating with a portable mobile terminal, this terminal detects a high-power vehicle-mounted mobile telephone, or while the
20 user is communicating data by using a single portable mobile terminal, this terminal detects a car navigation system.

Further, the present invention is not limited to sounds, but a similar concept is applicable to data
25 communications such as distribution of texts, images, or animated images.

As an application for multimedia communications, when

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a transmitter or the service control station 30 is provided with connection service information on the current call and a receiver is notified of the connection service information. Therefore, for example, when animated
5 images are to be transmitted, on condition that the available mobile terminal can deal with only sound communications, the mobile terminal can autonomously alter itself.

As described above, according to the present invention,
10 any one of the plurality of terminals sharing the same number determines whether or not to switch a transfer to another terminal sharing the same number. If it determines that the transfer is to be switched, it authenticates one terminal among the other terminals
15 sharing the same number, and then outputs a transfer switching request according to the authenticated terminal to the communication control station. The communication control station performs a transfer switching process concerning the authenticated terminal based on the
20 transfer switching request outputted by the first terminal. Consequently, when the user can use the same number with a plurality of mobile terminals, if one of the mobile terminals has the difficulty of continuing the communication or the user desires to continue the
25 communication by using another mobile terminal, then the call being communicated can be continued by allowing a second mobile terminal with which the communication is to

be continued to make a transfer request or allowing the communicating terminal to autonomously make a transfer request to the second terminal. Therefore, the user's convenience can be improved.

5 Further, in the conventional transfer services to another number communication charges not only at the source terminal but also from the source terminal to the destination terminal are imposed. However, according to the present invention, the switch and transfer process is performed by using the same number to avoid communication charges associated with this process, thereby achieving convenient and economical communications.

10 The present invention has been described in detail with respect to preferred embodiments, and it will now be apparent from the foregoing to those skilled in the art that changes and modifications may be made without departing from the invention in its broader aspect, and it is the intention, therefore, in the apparent claims to cover all such changes and modifications as fall within
15 the true spirit of the invention.
20